Collaboration Tools:
Meeting Interoperability Requirements in Today's Military

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Introduction:
Recent advances in communication and information technology have changed the face of military collaboration. The shift to network-centric operations at both the tactical and strategic levels provide the warfighter with improved abilities for sharing and leveraging information (Garstka, 2004). This shift to a knowledge-based force will have a direct impact on shared situation awareness, intelligence analysis and decision-making.

Despite these improvements, however, information technology is not without its problems. Because of the tremendous amount of data available, collaboration teams are often faced with information overload. Much of that information comes from open sources such as the internet. As a result, knowledge uncertainty becomes a primary concern. In addition, military intelligence is dynamic in nature, and is, therefore, constantly changing. Military strategists and operational personnel must continually monitor the flow of information to ensure accurate and timely mission planning and execution (Warner, Letsky & Cowen, 2004; Warner & Wroblewski, 2004).

Geographically distributed collaboration teams face additional burdens. Co-located teams have the advantage of "real-time" collaboration. On the other hand, distributed teams often receive information asynchronously. In addition, the widening realm of contributors often results in teams that represent a disparity of experience, knowledge and cultural backgrounds. To complicate the collaborative effort further, accessibility of enhanced commercial and military technology has resulted in a market flooded with diverse, often incompatible collaboration tools. Without significant oversight, this enhanced technology will serve to impede collaboration rather than improve it.

A Taxonomy of Collaboration Tools:
By definition, collaboration is the interaction between team members with the intent of creating "a shared understanding that none had previously possessed or could have come to on their own" (Schrage, as cited in Dargan, 2001). Schrage identifies three levels of collaboration. At Level 1, individuals work independently, interacting only at a basic level by sharing information to meet their own specific needs. Individuals engaged in Level 2 collaboration exchange information because of common interests, but not with the intent of achieving a common goal. At Level 3, individuals work as a team to achieve a common goal by sharing information and, as a result, gain new insights. This is the highest level of collaboration and the focus of most collaboration technology.

Bolstad and Endsley (2003) suggest that the primary processes for team collaboration include:

- Planning
- Scheduling
- Tracking information
- Brainstorming

- Document creation
- Data gathering
- Data distribution
- Shared situation awareness (SA)

With current technology, developing a single collaboration tool to address all of these processes would be a daunting task. A more practical solution is to develop different tools to support the different types of collaboration processes.

Current collaboration technology for geographically distributed teams are designed for either asynchronous or synchronous collaboration. Asynchronous collaboration allows users to access and store documents, files and messages at their discretion, regardless of when the information was sent (Deus, 2004; Dargan, 2001). Asynchronous collaboration applications include:

- E-mail: A network service that allows the transmission of electronic mail to other users. Users can create, send, receive, forward and sore these messages on a disk or computer.

- Bulletin Board: A centralized host computer used to store messages for members to share.

- People Locator: A feature that allows users to locate another user's user id.

- Group Calendar: The ability to share calendar information between users.

- Threaded Discussions: Virtual postings to which other users can link responses.

- Virtual Persistent Workspace: A virtual room where users collaborate through virtual teaming activities in an effort to problem solve.

Synchronous collaboration, on the other hand, focuses on real-time collaboration (Bolstad & Endsley, 2003; Deus, 2004; Dargan, 2001). Team members communicate and share ideas concurrently. Both formal and ad hoc collaboration sessions can be held through virtual meetings and data conferencing. Synchronous collaboration applications include:

- Audio Conferencing: Real-time teleconferencing between two or more participants connected by network, telephone or satellite link.

- Video Conferencing: Real-time visual display between two or more participants at different sites using computer networks to transmit audio and visual data. (Point-to-Point conferencing involves only two users; Multipoint conferencing allows for three or more users.)

- Awareness: A feature that allows users to know who is online.

- Chat/Instant Messaging: Real-time text-based communication.

- Shared Applications/Screen Sharing: A data conferencing tool allowing a user to view and control an application on another user's desktop.

- Whiteboard: A shared drawing board on the display that allows one or more participants to write, draw and review in real-time.

Military strategists and operational personnel must carefully analyze the situation at hand, as well as the capabilities of the users, to determining the collaboration tool that best supports their specific needs. At a minimum, the selected tool must be reliable, bandwidth-accessible, user-friendly, secure, interoperable with other systems, and flexible enough to accommodate real-life situations.

Congressional Mandate:
In an effort to meet diverse industry and consumer demands, the past ten years have seen a tremendous influx of commercial collaboration tools. Because the majority of these tools were developed to meet specific needs, interoperability issues between collaboration tools were not addressed. This lack of interoperability hindered the military's ability to meet the demands of a network-centric, knowledge-based force. Congress recognized this inconsistency, and in 1999 instructed the Department of Defense (DoD) and the Intelligence Community (IC) to address the lack of interoperability between fielded collaboration tools (CIWG, 2004; JITC, 2004). In response, the

Office of the Secretary of Defense (OSD) and the Joint Staff (JS) established a Collaboration Tiger Team (CTT). The CTT was instructed to develop a strategy for implementing the use of collaboration tools within DoD. In addition, they were tasked with defining and validating a prioritized list of functional requirements for these tools.

The CTT requested the Joint Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISIR) Battle Center (JBC) conduct an assessment of five DoD collaboration tools, focusing on the Joint Task Force (JTF) level (Crafton, 2001). The JBC assessment evaluated these tools using the following criteria:

- Cost

- Warfighting Utility:
    - Value of Function – Usefulness and performance
    - Value of Information – Accuracy, timeliness, completeness and relevancy

- Jointness:
    - Information Exchange – Operational, system and who-what-why
    - Security Risk – System and community

- Maturity:
    - Human Factors
    - Institutional Commitment
    - Fielding Assurance
    - Supportability
    - Requirements Match
    - IW Vulnerability

Based on four major assessment events conducted in two phases, the JBC recommended the Collaboration Tool Suite (CTS) as the interim standard DoD tool set. Following additional recommendations by the JBC, the CTS was renamed the Defense Collaboration Tool Suite (DCTS) in March, 2001.

DCTS:

The Defense Collaboration Tool Suite (DCTS) is not a single product, but rather an integrated set of applications providing interoperable, synchronous and asynchronous collaborative support to DoD agencies, Combatant Commands and military services. DCTS is a client/server system designed to provide an evolving set of open standards and serves as the bridge between DoD and the Intelligence Community. It provides standards-based services through commercial-off-the-shelf (COTS) applications and the necessary government-off-the-shelf (GOTS) applications needed to meet DoD requirements.

The current DCTS Version 2 consists of:

- **Microsoft NetMeeting**: Provides multi-point data conferencing, text chat, whiteboard, file transfer and point-to-point audio and video.

- **Asynchrony's Envoke**: A GOTS/COTS application providing awareness of other users, spaces and meetings.

- **Sun Microsystems SunForum**: Provides shared applications and conferencing for PC and UNIX operating systems.

- **Digital Dash Server**: A GOTS application based on Microsoft Digital Dashboard technology, providing space navigation, awareness, shared file space, access control, VTC conferencing, broadcast messages and system administration services.

- **First Virtual Communications Multi-Point Control Unit (MCU)**: Enables multi-point NetMeeting sessions.

- **Microsoft SQL Server**: A complete database and analysis tool.

Interoperability Requirements:
On 01 November 2002, the Assistant Secretary of Defense, Command, Control, Communications and Intelligence (ASD-C3I) released a memorandum requiring all collaboration tools used on DoD networks be tested for interoperability with DCTS by 01 March 2003. Tools that fail to meet interoperability certification requirements were unauthorized on DoD networks, effective 01 October 2003.

In an effort to support interoperability requirements, DoD created the Collaboration Management Office (CMO) within the Defense Information Systems Agency (DISA) to manage DCTS and to implement collaborative tools throughout DoD. The Joint Interoperability Test Command (JITC) within DISA is the sole joint and combined National Security Systems (NSS) and Information Technology (IT) systems interoperability test certifier for the DoD. JITC provides a testbed environment to test, evaluate and document the interoperability of proposed, or candidate, collaboration tools. All NSS and IT systems are considered to be for joint and combined use, and must be certified as interoperable.

In compliance with OSD C3I Policy Memo (01 November 02), "DoD Collaboration Interoperability Standards," all products operating on a DoD network that provide the following collaboration capabilities must be certified as "interoperable":

- Voice Conferencing
- Video Conferencing
- File Sharing
- Application Sharing
- Awareness
- Instant Messaging
- Whiteboarding

E-mail, studio-type (H.320) VTC and operating systems are not required to be tested at this time. The need for testing website/portals and office automation packages will be evaluated on a case-by-case basis.

The OSD/JS CTT established the following "14 Interoperability Criteria":

- Coexistence: The candidate tool shall coexist with DCTS environment

- Collaborator Status: Locate any collaborator

- Conference Discovery: Locate any ITU compliant conference (e.g., meeting) on any server

- Virtual Space Discovery: Locate any persistent space (e.g., room) on any server

- Text Conference: Text chat (instant message) with any person

- Virtual Space Access: Launch an application with default data to enter any "accessible" persistent space on any server

- Conference Join: Launch an application with default data to join any "accessible" conference on any server

- Application Sharing: Demonstrate the ability to share applications

- Whiteboard: Demonstrate the ability to annotate still images

- Audio: Demonstrate the ability to share audio

- Video: Demonstrate the ability to share video

- File Transfer: Import/export documents between meetings and rooms

- Authentication, Encryption, Lockdown: Provide appropriate security mechanisms (e.g., to get permission to connect to DoD networks) and not interfere with other collaboration components

- Usability, Stability and Performance: The product shall not substantially degrade collaboration usability, stability or performance

Three types of interoperability testing are available at JITC: systems testing, component testing and enhancement testing. A system is a tool, or set of tools that provide all of the services identified in the requirements and passes all fourteen of the interoperability criteria. All interoperability requirements for a candidate system that would interoperate with all DCTS modes and functions are tested.

A component is a tool or set of tools that fulfills one ore more, but not all, of the requirements and passes all of the required criteria identified in the component certification criteria matrix. Component testing tests a product designed to be interoperable with a DCTS function.

An enhancement is a tool or set of tools that fulfills one or more, but not all, or the requirements and has one or more enhanced functions not based on the reference standards profile. While enhancements to DCTS may not be able to demonstrate full interoperability, they must meet the criteria identified in the enhancement certification criteria matrix. Enhancement testing tests a product that provides one or more, but not all, of the fourteen interoperability criteria, and must include awareness and presence. The component and enhancement certification criteria matrix can be found at http://jitc.fhu.disa.mil/washops/jtcd/downloads/certmatrix_v87.xls.

All systems must be certified before fielding. Fielded systems must be recertified every three years, or in the event changes have been made that affect interoperability or supportability. Additionally, JITC cannot certify non-US systems for interoperability. It is the responsibility of the vendor to seek certification. All testing is conducted at the JITC Washington Operations Division in Indian Head, Maryland.

Interoperability Certification Process:
The Certification Team is comprised of the system proponent, the system developer, the system user representative and representatives from JITC. This team works together to:

- Identify joint interoperability requirements from available documentation, architectures and the operational environment

- Verify requirements and determine criticality for mission success

- Collect joint interoperability data from the appropriate test events and sources

- Perform an independent analysis of the interoperability test data to determine if the systems can exchange information and services with users in a joint environment

To be considered for testing, JITC requires the vendor to supply the following:

- The signed test agreement: This document can be accessed at http://jitc.fhu.disa.mil/washops/jtcd/downloads/testagreementv5.doc

- Funding for the appropriate level of test: Funding information can be found at http://jitc.fhu.disa.mil/washops/jtcd/dcts/jtcd_test_fees.html

- A completed entrance criteria checklist indicting for each criterion whether the product to be tested supports the corresponding standards listed. The checklist can be downloaded http://jitc.fhu.disa.mil/washops/jtcd/dcts/entrance_criteria_checklist.html

- A copy of any available installation, administration, operator documentation pertaining to the product(s) to be tested. This can be in the form of manuals, paper documentation or links to the document locations if available on the web.

The vendor is required to supply all necessary hardware and software, technical personnel (including administrators and capable users) and appropriate documentation. If the vendor is unable to meet the stated requirements, certification will be denied. The vendor may, at its discretion, request testing to be reinitiated after necessary corrections have been made.

For additional questions, contact JITC (1-800-538-5482, DSN 879-5482) or access the JITC website at http://jitc.fhu.disa.mil.

Summary:
"Interoperability is the foundation of effective joint, multinational, and interagency operations. The joint force has made significant progress toward achieving an optimum level of interoperability, but there must be a concerted effort toward continued improvement… Information systems and equipment that enable a common relevant operational picture must work from shared networks that can be accessed by any appropriately cleared participant." *(Joint Vision 2020)*

Military communication and information technology is rapidly evolving at both the tactical and operational levels. Reliance on effective collaboration tools for distributed teams has become critical to the military's efforts in mission planning and decision making. To ensure continued effectiveness, is imperative that this advancing technology enhance the collaborative effort rather than impede it. Interoperability of collaboration tools provides the key to network-centric operations and efficient warfighter initiatives.

Additional Information:

Chairman, Joint Chiefs of Staff Instructions (CJCSI):

1. http://www.dtic.mil/cjcs_directives/cdata/unlimit/3170_01.pdf: CJCSI 3170.01D, "Joint Capabilities Integration and Development System", March 12, 2004.

2. http://www.teao.saic.com/jfcom/ier/documents/CJCSI_6212_01C.pdf: CJCSI 6212.01C, "Interoperability and Supportability of NSS and IT Systems", November 20, 2003.

Defense Information Systems Agency (DISA):

1. http://www.disa.mil: DISA Home Page

2. http://www.disa.mil/main/prodsol/dcts.html: DCTS Fact Sheet

DoD Directives:

1. http://www.dtic.mil/whs/directives/corres/html/46305.htm: DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)", May 05, 2004.

2. http://www.dtic.mil/whs/directives/corres/html/46308.htm: DoD Directive 4630.8, "Procedures for Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)", June 30, 2004.

3. http://www.dtic.mil/whs/directives/corres/html/50001.htm: DoD Directive 5000.1, "The Defense Acquisition System", May 12, 2003.

4. http://www.dtic.mil/whs/directives/corres/html/51017.htm: DoD Directive 5101.7, "DoD Executive Agent for Information Technology Standards", May 21, 2004

Joint Interoperabilility Test Command (JITC):

1. http://jitc.fhu.disa.mil: JITC Homepage

2. http://jitc.fhu.disa.mil/washops/jtcd/dcts/documentation.html: DCTS Interoperability Program Documentation

3. http://jitc.fhu.disa.mil/washops/jtcd/downloads/collabor_interop.doc: Provides an explanation of what products must be tested for interoperability

4. http://jitc.fhu.disa.mil/washops/jtcd/dcts/jtcd_certificationprocess.html: Provides a flow chart of the Interoperability Certification process

5. http://jitc.fhu.disa.mil/washops/jtcd/dcts/entrance_criteria_checklist.html: Entrance Criteria Checklist

6. http://jitc.fhu.disa.mil/washops/jtcd/downloads/testagreementv5.doc: Defense Collaboration Interoperability Testing Application and Agreement

7. http://jitc.fhu.disa.mil/washops/jtcd/dcts/jtcd_test_fees.html: Collaboration Interoperability Testing Fee Schedule

8. http://jitc.fhu.disa.mil/washops/jtcd/dcts/interop_criteria_v8.html: Interoperability Criteria for Collaboration Tools

9. http://jitc.fhu.disa.mil/washops/jtcd/dcts/dctsv2_software_list.html: DCTS v2 Software List

10. http://jitc.fhu.disa.mil/washops/jtcd/downloads/certmatrix_v87.xls: Collaboration Interoperability Program Certification Matrix

11. http://jitc.fhu.disa.mil/washops/jtcd/dcts/index.html: Provides DCTS Information

12. http://jitc.fhu.disa.mil/jitc_dri/jitc.html: Policies and Guidance

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2. Chairman Joint Chiefs of Staff Instruction 6212.01B, "Defense Collaboration Tool Suite Joint Warrior Interoperability Demonstration 2002", dated 14 June 2002.

3. Chairman Joint Chiefs of Staff Instruction 3170.01D, "Joint Capabilities Integration and Development System", March 12, 2004.

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12. DoD Memorandum, "DoD Collaboration Interoperability Standards", dated 01 November 2002.

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